Public-Private Partnership in Agbiotech: The Case of Genetically Engineered Eggplant in India*

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Current scenario of ag-biotech

- Private sector investing $2.5 B annually in agbiotech

- Developing countries invest at but 5% level of private sector so applications must come from private sector
Why less public investment in Ag-biotech in developing countries?

- Costly novel traits
- High regulatory costs
- Poor technology transfer due to lack of proper IPR regulations in Developing countries
- Lack of human capital and R&D infrastructure
Solution?

- Humanitarian donations/public-private partnerships

- But, the question is whether these partnerships are feasible, and if so under what conditions
Two-Tiered Approach:

- **SMALL FARMERS:**
  HUMINITARIAN DONATIONS and PARTNERSHIPS
  Not a real cost for firms if mean ‘non commercial market’ – issue is segmenting markets

- **COMMERCIAL FARMERS:**
  Enhance incentive to transfer agbiotechnologies by selective strengthening IPR
Partnerships contd.

- Enhance access to technology for resource-poor farmers
- Generate public-good will
- National capacity build-up

BUT RISKS
- Loose control over technology
- Low-quality products from the partner
- Liability
  Both jeopardize commercial interests
Partnerships contd.

REQUIRES

- Developed seed sector and potential for market segmentation based on: crop & region, variety, trade status, community income level, or production system
- Trust between partners
Partnerships contd.

For example,

- Monsanto donated virus-resistant technology to Center for Research and Advanced Studies (Mexico), under royalty-free license agreement. The transfer was brokered by ISAAA to develop virus-resistant *local varieties* (not for processing types) of potatoes in *Mexico* (1991).
But Mexican project was not economically viable

- virus infection was not the major constraint for the potato growers (less market value)
- Virus damage not readily visible
- cost of transforming and propagation relatively high

However, Monsanto’s profits were not threatened because small-scale farmers were difficult to reach in the commercial market
Public-private partnership

Another Example: Bt eggplant in India

- One of the important non-seasonal vegetable crops in India
- Both hybrids and open pollinated varieties grown by farmers
- Nationally 30% of farmers use hybrids
Bt eggplant (contd.)

- Eggplant shoot and fruit borer (ESFB) is the most destructive pest, reduces yield up to 70%
- ESFB damage readily visible
- Farmers use pesticides to control the pest, in many cases over-use is reported
Bt eggplant (contd.)

- Mahyco (Indian seed company, Monsanto owns 26% share) developed *Bt* hybrid eggplant providing resistance to targeted pest (ESFB)

- Donated *the technology* to public institutions in India to develop **Bt OPV varieties of eggplant**, while company focuses on *Bt* hybrid eggplant.

- Donated the toxicology package they have for Bt hybrid eggplant
Bt eggplant (contd.)

- Bt hybrid eggplants received regulatory approval for large-scale trials.
- Bt OPVs are under development by institutions such as TNAU, UAS, Dharwad
Large scale trials of Bt hybrid eggplant (photos by Dr. Frank A. Shotkoski)
TNAU Bt OPV eggplant trials
UAS Dharwad, Bt OPV seedlings in GH
Is the public-private partnership feasible?

- ISSUES: will existence of low-priced Bt OPVs cannibalize the Bt hybrid market?
- What are the conditions for the co-existence of Bt hybrid and Bt OPV technologies?
- Is it replicable for other crops in other countries?
Data Collection

- Farm-level survey in Maharashtra 2004-2005 to collect data on eggplant production practices, farmers’ willingness to pay for Bt technology, etc.
- 249 eggplant farmers and 41 non-eggplant vegetable farmers participated
Eggplant production practices

- Hybrid eggplant yield 47% higher than OPV
- Hybrid farmers spend 1.5 times more on pesticides
- Hybrid farmers have better access to credits, markets, irrigation
- Hybrid farmers have higher land value
Fig 1: Map of the study area
Field trials of hybrid *Bt* eggplant

- Report 52% decrease in pesticide use, and 39% decrease in the number of sprayings of *Bt* plots
- Average yield from *Bt* plots 117% higher than non-*Bt* counterparts.
- Trials pending for *Bt* OPV but assume same proportional benefits in yield and pesticide use
Results from partial budget analysis for hybrid growers

<table>
<thead>
<tr>
<th></th>
<th>Cost/return</th>
<th>Hybrid to Bt hybrid (Rs/ha)</th>
<th>Hybrid to Bt OPV (Rs/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>i</td>
<td>Pesticide savings (40%)</td>
<td>13076</td>
<td>25380</td>
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<tr>
<td>ii</td>
<td>Yield benefits (48%)</td>
<td>47086</td>
<td>584</td>
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<tr>
<td>iii</td>
<td>Sub-total returns</td>
<td>60162</td>
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<td>iv</td>
<td>Seed prices</td>
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<tr>
<td></td>
<td>1 est. WTP</td>
<td>12004 (max)</td>
<td>1163 (average)</td>
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<td></td>
<td>2 est. WTP</td>
<td>6625 (average)</td>
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<tr>
<td>v</td>
<td>Net returns</td>
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<tr>
<td></td>
<td>(iii-iv1)</td>
<td>48158</td>
<td>24801</td>
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<tr>
<td></td>
<td>(iii-iv2)</td>
<td>53537</td>
<td>25964</td>
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</tbody>
</table>
Results contd.

- Hybrid farmers gain more from adopting Bt hybrid than low-priced Bt OPV

- Hence no incentive to switch to low priced Bt OPVs once available
## Results from partial budget analysis for OPV growers

<table>
<thead>
<tr>
<th></th>
<th>Cost/return</th>
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<tbody>
<tr>
<td>i</td>
<td>Pesticide savings (40%)</td>
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<tr>
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<td>Yield benefits (48%)</td>
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<td>Sub-total returns</td>
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<tr>
<td>iv</td>
<td>Seed prices</td>
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<td>(iii-iv1)</td>
<td>36117</td>
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<td>(iii-iv2)</td>
<td>37280</td>
<td>64213</td>
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</table>
Results contd.

- Resource limited farmers could gain more from adopting *Bt* hybrid mainly because of the yield benefits.
- However, there are constraints for this adoption: capital, market access, risk, etc.
- Earlier study reported OPV farmers have higher probability to adopt *Bt* OPV due to socio-economic and production characteristics.

Results from sensitivity analysis shows similar trend.
Conditions facilitating co-existence of Bt hybrids and Bt OPVs

- Production systems of hybrid and OPV eggplant are different (access to irrigation, access to credit, markets, land value)
- Scope for market segmentation
- Hybrid growers have higher WTP for Bt technology
Conclusion

- Royalty-free *Bt* OPV will not affect company profits
- Mahyco benefits from the public institution participation by building public relations.
- This kind of segmentation is possible for other crops when different levels of production technologies are used based on access to irrigation, market, credit and land values.
Thank You